HABITAT SELECTION OF POSTLARVAL *EUTROMBICULA ALFREDDUGESI* AND *EUTROMBICULA SPLENDENS* FROM EIGHT MICROHABITATS IN GEORGIA, U.S.A. (TROMBICULIDAE: ACARINA)

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ABSTRACT

Eight microhabitats on the Piedmont and Coastal Plains of Georgia were sampled for postlarval *Eutrombicula alfreddugesi* and *E. splendens*. Five microhabitats (soil, surface litter, tree holes, tree stumps, and logs) yielded postlarvae. No postlarvae were found in Spanish moss, vertebrate nests or tree bark. All postlarvae collected on the Piedmont were *E. alfreddugesi*, and those from the Coastal Plain were *E. splendens*. Tree stumps yielded the most postlarvae, the greatest percent of samples with postlarvae and the most larvae per 100 grams of habitat. Soil yielded the second highest number of postlarvae but contained the lowest percent of samples with postlarvae, and contained the fewest postlarvae per 100 grams of habitat.

Key Words: Chiggers, Trombiculidae, *Eutrombicula alfreddugesi, Eutrombicula splendens*

INTRODUCTION

Larval stages of trombiculid mites, or "chiggers", are medically and economically important. Consequently, most ecological and taxonomic research has concentrated on this life history stage. Chiggers are frequently collected during ectoparasite surveys. Postlarval stages are infrequently found, and little is known about their ecology.

Postlarval Trombiculidae are free-living predators in soil and litter habitats (Krantz 1978), but are rarely collected in the field (Farner 1946, Brown 1952, Crossley 1960). Hirst (1926) hypothesized that postlarval chiggers would be found in nests of their vertebrate hosts. However, Andre (1928) and Keay (1937) investigated nests of bank voles (*Clethrionomys gloreolus*) and rabbits (*Oryctolagus cuniculus*) that were infested with chigger larvae, and failed to find postlarvae. A number of authors have collected postlarval chiggers from various habitats. Kawamura and Ikeda (1936, cited in Sasa 1960) collected adults of *Trombicula akamushi* Nagayo *et al.* from soils in Japan. They reported that postlarvae were most abundant in the upper 3 cm of the soil, and that some adults were recovered as deep as 18 cm. Cockings (1948) and Jones (1950) collected adults of the "Harvest mite," *Trombicula autum-*

nalis Shaw, from soils, but the depth at which postlarvae were found depended on temperature and soil moisture. Cockings (1948) reported that *T. autumnalis* migrates upward to within 10 cm of the soil surface during summer when soil is moist, and maximum soil surface temperature reaches 26.6 C. However, the majority of adult *T. autumnalis* were found between 10-20 cm below the soil surface and usually within 4.6 meters of rabbit burrows. Cockings (1948) also reported that adult *T. autumnalis* go deeper in the soil following heavy, continuous rains, irrespective of temperature, oor during prolonged droughts. Adults of *T. autumnalis* have been collected at depths of 30.5-45.7 cm (Cockings 1948), and Richards (1950) reported that adult *Eutrombicula batatas* L. and *Trombicula scutellaris* Nagayo *et al.* are abundant on the soil surface in tropical areas, especially during the wet season. Nadchatram (1970) collected postlarval stages of chiggers (*Leptotrombidium akamushi* Nagayo *et al.*) from soils. Loomis (1954) collected nymphs and adults of *Eutrombicula alfreddugesi* (Oudemans) from soil underneath large flat limestone slabs, and in decaying logs, just beneath the loose bark and in the decomposing wood. Wolfenbarger (1952) collected deutonymphs and adult *E. alfreddugesi* under rocks in wooded areas immediately after rains, and on warm sunny days, in open pastures a few centimeters beneath the soil surface in cracks and crevices made by grass roots.

We report here on habitat selection of postlarval stages of *Eutrombicula alfreddugesi* and *E. splendens* (Ewing) which may contribute to our understanding of chigger mite infestations and control.

METHODS AND MATERIALS

Eight microhabitats were sampled for active postlarval stages (deutonymph and adult) of *Eutrombicula* spp., over a two year period. Microhabitats examined were soil, surface litter, tree holes, tree stumps, Spanish moss (*Tillandsia usnoides* L.), logs, nests, and tree bark. Forests, fields and disturbed habitats, were sampled on the Piedmont in Athens, Clarke County, Georgia. Sand dunes and coastal woodlands were sampled on the coastal plains at St. Simons Island and Jekyll Island, Glynn County, Georgia.

Soil habitats examined in this study were sampled by taking ca. 5 x 5 cm and 5 x 15 cm soil cores, and by using a 20 x 20 x 5 cm square soil sampling device. Soils examined ranged from nearly pure sands from the Jekyll Island sand dunes to heavy clay soils of the Georgia Piedmont.

Surface litter microhabitats consisted of coniferous and deciduous leaf litter and other organic debris in various stages of decomposition. An average of 359.7 grams of surface litter per sample were collected for extraction. Tree stumps examined in this study were all *Pinus* spp. in advanced stages of decay, and could easily be torn apart with bare hands. Much of the wood in decomposing tree stumps was soil-like in texture. An average of 707.6 grams per sample of stump material was collected fro extraction. Tree holes examined in this study were from Live Oak (*Quercus virginiana* L.) and were located on the ground at the base ot trees, or were from one to five meters off the ground. Material examined from tree holes consisted of accumulated soil and other organic debris. Samples of Spanish moss were collected from

the ground and trees. Collections of nests and nest materials were made from recently abandoned bird and mammal nests. Tree bark, from live and dead trees, and logs were examined visually, usually in the field. Only instances when postlarvae were found from logs or bark were recorded.

"Total habitat" is defined in this paper as the total amount of microhabitat examined, and "positive habitat" is the portion of respective microhabitat in which postlarvae were found.

Funnel extraction of flotation methods were used to extract postlarval chiggers from soil, tree hole, tree stump, surface litter, nests, and Spanish moss habitats (Mallow and Crossley 1984). Postlarvae collected alive were kept alive for laboratory culture. All other postlarvae were preserved in 90% ethyl alcohol or mounted on slides.

RESULTS

A total of 94 postlarval *Eutrombicula* were collected from the various microhabitats. All postlarvae collected from the Georgia Piedmont were identified as *E. alfreddugesi* and all postlarvae from the coastal plain were *E. splendens*. Active postlarval chiggers (deutonymphs and adults) were collected in five microhabitats (soil, surface litter, tree stumps, tree holes, and logs). No postlarvae were found in Spanish moss, vertebrate nests, or tree bark. Results of the postlarval collections are summarized in Table 1.

Table 1. – Summary of habitat selection by postlarval *Eutrombicula alfreddugesi* and *E. splendens* recovered from microhabitats in Georgia.

	Soil	Litter	Tree Stumps	Tree Holes
Total samples examined:	1255	52	63	39
Mean weight per sample (grams):	230.4	359.7	707.6	353.0
Number of postlarvae collected:	26	8	46	14
Percent samples with postlarvae:	1.8%	15.4%	25.4%	7.7%
Number of postlarvae per 100 grams total habitat:	1.9	1.9	3.48	1.64
Number of postlarvae per 100 grams total habitat:	0.08	0.48	1.03	1.02
Number of samples with postlarvae:	22	8	16	3

The highest number of postlarvae (46) was collected from rotting tree stumps. This habitat also contained the highest percentage of samples with postlarvae (25.4%), and the most postlarvae per 100 grams of positive and total habitat (3.5 and 1.0, respectively). Soil yielded the second highest number postlarvae (26). However, soil had the lowest percent of samples with postlarvae (1.8%), and the lowest number of postlarvae per 100 grams of positive and total habitat (1.9 and 0.1, respectively). Tree holes contained the third highest number of postlarvae collected (14) and percent of samples with postlarvae (7.7%). Tree hole microhabitats also contained the second highest number of postlarvae per 100 grams of positive habitat and total habitat (1.6 and 1.0, respectively). The fewest postlarvae were collected from surface litter (8), which also contained the lowest number of postlarvae per 100 grams of positive habitat (1.9). Surface litter had the second highest percent of samples with postlarvae (15.4%), and the third lowest number of postlarvae per 100 grams of total habitat. Nine postlarval *Eutrombicula* were collected from logs.

DISCUSSION

The collection of only 94 individual postlarval *Eutrombicula (E. alfreddugesi, E. splendens)* from over 1400 samples confirms reports by Farner (1942), Brown (1952) and Crossley (1960) that postlarval stages of trombiculid mites are rarely found. We feared that the low number of postlarvae collected was due to low efficiency of extracting deutonymph and adult chiggers from environmental samples. However, Mallow and Crossley (1984) showed that postlarvae could be extracted from soil and litter habitats with greater than 90% efficiency.

The absence of postlarvae in vertebrate nests is in agreement with Andre (1928) and Keay (1937). Contrary to reports by Loomis (1954), no postlarvae were collected within or underneath bark, from either live trees or dead and decaying logs. Also, contrary to popular folklore, no chiggers, either larvae or postlarvae, were collected from Spanish moss.

Most published reports of postlarval habitat preference indicated soil to be a favored habitat. However, our data failed to show this. Significantly more soil samples were taken than from any other positive postlarval microhabitat (litter, tree stumps, tree holes, logs), yet the soil habitat yielded only the second highest number of postlarvae, the lowest percent of samples with postlarvae, and the lowest number of postlarvae per 100 grams of positive and total habitat. Once again concern arose over whether our methods were effective, specifically whether soil samples were taken deep enough, comparable to depths reported by Cockings (1948) and Richards (30.5-45.7 cm, ca. 1 meter, respectively). However, more than 95% of all soil samples taken were from the Georgia Piedmont, where the soil was a heavy clay dead pan approximately 7-10 cm below the soil surface. It is unlikely that many microarthropods, particularly those as large as postlarval trombiculids could penetrate beyond this depth. Over 58% of all postlarvae recovered from soil were collected from the Georgia Piedmont. The remaining postlarvae were collected from soils on the Georgia coastal plain (42% of total postlarvae from

soil, from 5% of total soil samples). Soils from the Georgia coast are very sandy, and consequently porous, permitting even large microarthropods to migrate down to deeper soil layers. Although soil samples were not taken deeper than 15 cm in this porous coastal soil, we feel the efficiency of collecting postlarvae from this habitat was not compromised for two reasons. First, a relatively high number of postlarvae were collected from a small number of samples, compared with soil samples from the Piedmont. Secondly, a much larger number of postlarval *E. splendens* were collected from tree stumps and tree holes than from soils on the coastal plain. This suggests that soil is not a preferred habitat for *E. splendens* in coastal habitats.

Tree stumps in advanced stages of decomposition yielded the highest number and the greatest percent of total samples with postlarvae. However, only tree stumps from the coastal plain (77.8% of total tree stump samples) yielded postlarvae (*E. splendens*). No postlarvae were found from tree stumps on the Georgia piedmont. Tree stumps also yielded the highest number of postlarvae per 100 grams of positive and total habitat. Tree holes were only sampled from the coastal plain and all postlarvae recovered from this microhabitat were *E. splendens*. Deciduous trees on the Piedmont which had tree holes were devoid of chigger larvae and therefore were not sampled.

Surface litter yielded the lowest number of postlarvae, but was still apparently a preferred postlarval habitat over soil because litter contained a greater percent of samples with postlarvae and larger number of postlarvae per 100 grams of habitat. More than 62% of all postlarvae recovered from surface litter were collected from the coastal plain (*E. splendens*) from only 36.5% of all litter samples examined.

Over 30 postlarvae were collected in the field by direct observation. Of these, nine were from logs. The remainder were from rotting tree stumps. However, it should be noted that the ratio of postlarvae found to time spent examining logs and stumps was low. Therefore, we recommend that postlarvae be collected by passive extraction techniques such as funnel extraction or fictation.

In conclusion, the information gained from this study serves as a first attempt to quantify the distribution of postlarval pest chiggers. Through an understanding of habitat preferences and other ecological parameters, new methods of control may be directed at these postlarval stages. Because postlarvae occur in such low numbers, control methods may be more effectively directed at these life stages than at the more ubiquitous parasitic larvae.

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